

**REMARKS**

Claims 1-18 are pending. By this amendment, claims 1-15 and 17-18 are amended.

The Office Action rejects claims 1-2 and 4-6 under 35 USC § 103 over Kishiyu (JP 02275043) in view of Yuji (JP 58 065974). This rejection is respectfully traversed.

The present invention is directed to solving a problem present in a multi-cylinder in-cylinder injection type internal combustion engine, namely that in such in-cylinder injection type internal combustion engines, the injector valves are provided in the combustion chamber, which causes mechanical noise in the combustion chamber due to opening and closing of the valve. This noise may be mistakenly sensed as knocking. The present invention solves this problem by: 1) setting a knock determination period corresponding to a first cylinder in accordance with a fuel injection timing at a second cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder; and 2) setting the fuel injection timing at a second cylinder in accordance with the knock determination period corresponding to a first cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder. An engine that is not such a multi-cylinder in-cylinder injection type internal combustion engine will not have the problem of the valve opening and closing causing mechanical noise in the combustion chamber, because the valve are located outside of the combustion chamber.

Neither Kishiyu nor Yuji disclose or suggest a multi-cylinder in-cylinder injection type internal combustion engine as required by independent claims 1 and 4. Further, neither Kishiyu nor Yuji disclose or suggest a relationship between the knock determination period corresponding to a first cylinder in accordance with the fuel injection timing at a second cylinder, as recited in claims 1 and 4. Details of these arguments are set forth below.

Kishiyu discloses that because mechanical noise is produced by sliding connecting pins 640, 642 of an intake/exhaust valve mechanism in a through hole of locker arms 614, 616, 618 at the time of switching between high and low speed valve timings, knock

determination is exhibited at the time of switching valve timing in order to prevent the noise from being determined mistakenly as knocking. Kishiyu is thus subject to noise produced in the intake/exhaust valve mechanism, not the fuel injection valve. Thus, Kishiyu does not disclose or suggest setting the knock determination period corresponding to a first cylinder in accordance with a fuel injection timing at a second cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder, as recited in claim 1 of the application. Kishiyu also does not disclose or suggest setting the fuel injection timing at a second cylinder in accordance with the knock determination period corresponding to a first cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder, as recited in claim 4 of the application. Further, Kishiyu is not an in-cylinder injection type internal combustion engine as required by claims 1 and 4.

Yuji does not solve these deficiencies. Yuji discloses that, because electrical noise is produced due to current being emerged in a fuel injection valve, the timing when the current is emerged in the fuel injection valve is set so as to not overlap with the knock determination period for that cylinder in order to prevent the electric noise from being determined mistakenly as knocking. The claimed invention uses the relation between the knock determination period corresponding to the first cylinder and the fuel injection timing at the second cylinder, unlike Yuji, which is using a relation between a knock determination period and the fuel injection for the same cylinder. Further, Yuji is not an in-cylinder injection type internal combustion engine.

Neither Kishiyu nor Yuji set the knock determination period corresponding to a first cylinder in accordance with a fuel injection timing at a second cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder, or setting the fuel injection timing at a second cylinder in accordance with the knock determination period corresponding to a first cylinder so as to avoid a case in which mechanical noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder, as respectively recited in claims 1

and 4 of the application. Kishiyu is focused on preventing noise from the intake/exhaust valve mechanism interfering with a determination of knocking, while Yuji is focused on electrical noise in the same fuel injection valve (not in a second valve as required by the claims). Thus, even if combined, the combination would not result in the claimed invention.

Further, it is submitted that one of ordinary skill in the art would not have combined the references as suggested. In particular, Kishiyu is subject to mechanical noise produced in the intake/exhaust valve mechanism, while Yuji discloses electrical noise, and is not an in-cylinder injection type internal combustion engine.

For the above reasons, it is submitted that claims 1-2 and 4-6 would not have been obvious over the applied references and withdrawal of the rejection is requested.

The office action rejects claims 3 and 7-18 under 35 USC § 103 over Kishiyu in view of Yuji and further in view of Hosoya (US Pat. 5,144,929). This rejection is respectfully traversed.

Independent claim 8 is an apparatus claim that corresponds to method claim 1 and independent claim 11 is an apparatus claim that corresponds to method claim 4. Independent apparatus claim 14 contains recitations from both and recites a changing device that changes at least one of the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder based on a determination result from the determining device so as to avoid a case in which the mechanical noise produced by operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder. These claims are allowable for the same reasons discussed above regarding claims 1 and 4, and because Hosoya does not solve the above-noted deficiencies of Kishiyu and Yuji.

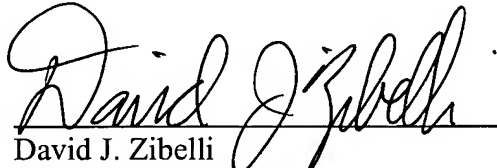
In fact, Hosoya discloses that because mechanical noise is produced by intake and exhaust valves opening and closing, if it is determined that noise is mistakenly sensed as knocking, the sensed valve is inhibited from being used for setting injection timing.

For the above reasons, it is submitted that claims 3 and 7-18 would not have been obvious over the applied references and withdrawal of the rejection is requested.

The Commissioner is hereby authorized to charge any additional fees under 37 C.F.R. 1.16 and 1.17, or credit any overpayment to Kenyon & Kenyon Deposit Account No. 11-0600. A duplicate copy of this authorization page is attached.

Should the Examiner have any further questions or comments, he is invited to contact the undersigned attorney at the telephone number indicated.

Respectfully submitted,

  
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